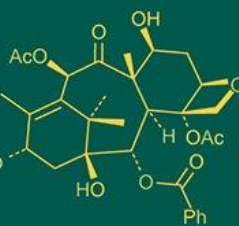
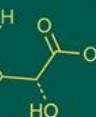
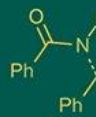


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Effect of integrated nutrient management on fruit growth, yield and quality of guava (*Psidium guajava* L.) cv. Allahabad safeda

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Abstract

An investigation was conducted at Horticulture Research Farm, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur (U.P.), during the year November 2025 –March 2026 to assess the effect of integrated nutrient management on fruit growth, yield and quality of guava (*psidium guajava* l.) cv. Allahabad safeda. The experiment was conducted in a Randomized Block Design with three replications. The experiment consisted of ten treatments viz., T₀Control, T₁N: P: K 600:200:400 gm (Recommended dose), T₂75% Recommended dose of N P K + 15 kg FYM, T₃75% Recommended dose of N P K + 6 kg Vermicompost, T₄50% Recommended dose of N P K + 25 kg FYM, T₅50% Recommended dose of N P K + 6 kg Vermicompost, T₆75% Recommended dose of N P K + 15 kg FYM.+6kg Vermocompost +3kg Neem cake, T₇50% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake, T₈50% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake+250g Azotobacter and T₉75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter. The results showed significant effect of integrated nutrient management on fruit growth, yield and quality of guava (*psidium guajava* l.) cv. Allahabad safed. In the present investigation concluded that among the different treatment combinations the treatment T₉ 75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was superior in respect to fruit growth, yield and quality parameters. Maximum benefit cost ratio (1:4.95) was recorded in treatment T₉ 75% Recommended dose of N P K + 6 kg Vermicompost and the minimum net return (1:0.80) was recorded in T₀ (control). The treatment was also recorded best as for as shelf life is concern.

Keywords: INM, flowering, yield, fruit quality, guava, Allahabad Safeda

Introduction

Guava (*Psidium guajava* L.), often referred to as the apple of the tropics, is among the most prevalent fruit crops in India. This fruit is native to Peru, Mexico, and tropical regions of America. The introduction of guava to India occurred in the early seventeenth century, brought by the Portuguese. It belongs to the Myrtaceae family of plants. Guava is sometimes called the "poor man's apple" owing to its delightful flavor, high nutritional content, and affordability. At present, guava has secured a robust market presence across more than 60 countries globally. It is cultivated in various regions including India, Algeria, Australia, Brazil, California, China, Colombia, Costa Rica, Cuba, Egypt, Florida, Hawaii, Indonesia, Israel, Java, Kenya, Malaysia, Mexico, New Zealand, Panama, Pakistan, the Philippines, Spain, South Africa, and the USA. In India, the area allocated for guava farming spans 307,000 hectares, yielding a total production of 4,516,000 metric tons (Anon. 2022), which translates to a productivity rate of 14 metric tons per hectare (NHB Database 2019-20). Guava is primarily grown in states such as Uttar Pradesh, Madhya Pradesh, Maharashtra, Bihar, West Bengal, Gujarat, Andhra Pradesh, Punjab, Tamil Nadu, Karnataka, and Assam. In northern India, guava flowers twice a year, with the initial bloom taking place from April to May in preparation for the rainy season (July-August), which is known as Amba Bahar. The fruits that emerge from the flowers during the rainy season mature in winter (November-December) and are referred to as Mrig Bahar (Gupta and Nijjar, 1978) ^[25]. In Maharashtra,

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Tamil Nadu, and other southern states, there is a third crop that blossoms in winter and yields ripe fruits in spring, called Hast Bahar (Hayes, 1970) ^[26]. Guava fruits are mainly consumed fresh with their skin after harvesting. However, they are also processed commercially into a variety of products including jam, cream, jellies, nectar, powder, puree, juice, and cheese (Dhillon, 2013) ^[27]. The fruits, leaves, and roots of guava are used in the treatment of diarrhoea and dysentery, and they are also ingredients in the formulation of other traditional medicines (Ojewole *et al.*, 2008) ^[28]. Guava is a hardy fruit crop, capable of thriving in poor alkaline or poorly drained soils with minimal fertilization and irrigation. In North India, guava flowers twice annually, first in February-March for the rainy season crop, and then in June-July for the winter season crop (Mitra *et al.*, 2008). Generally, the fruit yield is higher in the rainy season crop compared to the winter season (Rathore and Singh, 1974), but the fruits from the rainy season tend to be of lower quality, lacking flavor, and are more vulnerable to pests and diseases such as fruit flies in comparison to the winter season fruits. Additionally, winter season fruits have a longer shelf life and can be transported over longer distances without spoiling (Singh, 2013). The fruits harvested during the winter season are of superior quality, thus fetching a higher price in the market. Guava is usually eaten fresh, encompassing both the skin and pulp, which suggests the feasibility of organic farming in its production. Indian farmers primarily engage in organic farming; however, in recent years, especially following the green revolution, there has been a notable rise in the application of chemical fertilizers and pesticides. This trend has adversely affected both the environment and human health. Typically, guava trees produce fruit nearly throughout the year, making it essential to apply the appropriate amounts of nutrients to sustain the tree's productivity and health. There should be a significant emphasis on improving fertilizer use efficiency in conjunction with productivity, profitability, sustainability, and environmental friendliness. As a result, without the consistent application of organic manure and the recycling of crop residues, it becomes difficult to uphold and sustain productivity. Therefore, nutrient management strategies that integrate both organic and inorganic sources could prove to be very effective in creating a cost-efficient and environmentally sustainable program. Integrated nutrient management (INM) entails the deliberate combination of organic inputs (such as manures, compost, bio-fertilizers, green manure, and crop residues) with inorganic fertilizers to enhance crop yields and increase farmers' profitability, while also improving crop quality and reducing nutrient losses to the environment. In the context of guava cultivation, INM represents the improvement of soil fertility and the provision of plant nutrients to an optimal level that promotes the desired productivity and fruit quality by maximizing the benefits from all available sources in a cohesive manner (Kumar *et al.*, 2022) ^[13].

Materials and methods

This chapter contains the details of methodology and materials used during experimentation the investigation entitled "Effect of integrated nutrient management on fruit growth, yield and quality of guava (*Psidium guajava* L.) cv. Allahabad safeda " was conducted at the experimental orchard of Horticulture Research Farm, Faculty of Agricultural Sciences and Allied Industries, Rama

University, Kanpur (U.P.), during the year 2025-2026. The experimental site for this study is located at the during the *rabi* season of 2025-2026 Positioned approximately 25 km from the district headquarters of Uttar Pradesh 208024. The farm is situated at 20°16' North latitude and 80°08' East longitude in the southwestern plains of Uttar Pradesh. It sits at an altitude of 180 meters above sea level, falling within the subtropical zone. The application of integrated nutrient management was carried out on guava (*Psidium guajava* L.) variety Allahabad Safeda. A total of thirty uniform plants, each six years old and spaced 8×8 metres apart, were selected for the study. The experiment was executed with three replications using a randomized block design. The experiment was conducted in a Randomized Block Design with three replications. The experiment consists of 10 treatments including control. The treatment details viz., T₀ Control, T₁ N: P: K 600:200:400 gm (Recommended dose), T₂ 75% Recommended dose of N P K + 15 kg FYM, T₃ 75% Recommended dose of N P K + 6 kg Vermicompost, T₄ 50% Recommended dose of N P K + 25 kg FYM, T₅ 50% Recommended dose of N P K + 6 kg Vermicompost, T₆ 75% Recommended dose of N P K + 15 kg FYM.+6kg Vermocompost +3kg Neem cake, T₇ 50% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake, T₈ 50% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake+250g Azotobacter and T₉ 75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotobacter were used. Observations were recorded physical characters/parameters viz., days to first flower initiation, number of flowers per tree, number of flower cluster's per tree, percentage of fruit set, number of fruits per tree, fruit weight (g), fruit polar diameter (cm), fruit radial diameter (cm), specific gravity (w/v), fruit yield (kg/tree) and fruit yield per hectare (t/ha) and chemical constituents/chemical parameters viz., total soluble solids (⁰brix) and ascorbic acid/vitamin-c (mg/100 ml of juice), acidity (%), total sugars (%), reducing sugars, non-reducing sugars (%) and sugar/acid ratio. Statistical analysis of the data obtained in the different set of experiments was calculated as suggested by Panse and Sukhatme (1985).

Results and discussion

The Data relevant to flowering, fruit growth and yield of guava is presented in the Table 1. The data shown that application of different integrated nutrient management have significant effect on days to first flower initiation as compare to control (T₀). Treatment T₉ (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotobacter) was taken minimum days to initiation of flowering (21.60) which was followed by treatment T₈ (50% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neemcake+250g Azotobacter) and T₆ (75% Recommended dose of N P K + 15 kg FYM.+6kg Vermocompost +3kg Neem cake). Control (T₀) was taken maximum days to initiation of flowering (39.62). The data shown that application of different integrated nutrient management have significant effect on number of flower per tree as compare to control (T₀). Treatment T₉ (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotobacter) was taken maximum number of flower per tree (551.63). Control (T₀) was taken minimum number of flower per tree (258.71). The data

shown that application of different integrated nutrient management have significant effect on number of flower cluster's per tree as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum number of flower cluster's per tree (470.93). Control (T_0) was taken minimum number of flower clusters per tree (178.02). The data shown that application of different integrated nutrient management have significant effect on percentage of fruit set (%) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum percentage of fruit set (%) (68.29). Control (T_0) was taken minimum percentage of fruit set (%) (41.19). The data shown that application of different integrated nutrient management have significant effect on number of fruits per tree as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum number of fruits per tree (106.57). Control (T_0) was taken minimum number of fruits per tree (106.57). The data shown that application of different integrated nutrient management have significant effect on fruit weight (g) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum fruit weight (g) (185.10). Control (T_0) was taken minimum fruit weight (g) (80.13). The data shown that application of different integrated nutrient management have significant effect on polar diameter (cm) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum polar diameter (cm) (7.77). Control (T_0) was taken minimum polar diameter (cm) (5.46). The data shown that application of different integrated nutrient management have significant effect on radial diameter (cm) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum radial diameter (cm) (8.51). Control (T_0) was taken minimum radial diameter (cm) (6.21). The data shown that application of different integrated nutrient management have significant effect on specific gravity (w/v) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum specific gravity (w/v) (0.86). Control (T_0) was taken minimum specific gravity (w/v) (0.57). The data shown that application of different integrated nutrient management have significant effect on fruit yield (kg/tree) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum fruit yield (kg/tree) (69.72). Control (T_0) was taken minimum fruit yield (kg/tree) (8.54). The data shown that application of different integrated nutrient management have significant effect on fruit yield (t/ha) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum fruit yield (t/ha) (108.77). Control (T_0) was taken minimum fruit yield (t/ha)

(13.32). This result may be due to a better nutritional environment developed by the application of both organic manure along inorganic fertilizers, which resulted in improved soil physico-chemical and biological activities. Integrated application of different fertilizers, organic manures and biofertilizers enhanced the vegetative growth character, number of fruits and yield in guava cv. Sardar Ram *et al.*, (2007) ^[19], Shukla *et al.*, (2009) ^[24] and Dwivedi (2013) ^[11]. Athani *et al.*, (2007 a, b) ^[2, 3, 4] reported that organic and inorganic fertilizers on guava cv. Sardar. Application of 75% RDF + 10 kg vermicompost was found significant in yield and fruit quality. Ram *et al.*, (2007) ^[20] reported that the application of different fertilizers, organic manures and biofertilizers improve the vegetative growth, number of fruits and yield of guava cv. Sardar. Similar findings have been reported by Kumar *et al.*, (2009) ^[14], Dutta *et al.*, (2009) ^[8], Patel *et al.*, (2009) ^[18], Shukla *et al.*, (2009) ^[24], Agnihorti *et al.*, (2013) ^[1], Dwivedi (2013) ^[11], Athani *et al.*, (2007) ^[2, 3, 4], Dwivedi *et al.*, (2010) ^[11] and Binepal *et al.*, (2013) ^[6].

The Data relevant to biochemical analysis is presented in the Table 2. The data shown that application of different integrated nutrient management have significant effect on total soluble solids (Brix⁰) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum total soluble solids (Brix⁰) (12.76), Control (T_0) was taken minimum total soluble solids (Brix⁰) (9.09). The data shown that application of different integrated nutrient management have significant effect on ascorbic acid (mg/100 ml of juice) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum ascorbic acid (mg/100 ml of juice) (221.43). Control (T_0) was taken minimum ascorbic acid (mg/100 ml of juice) (158.61). The data shown that application of different integrated nutrient management have significant effect on acidity (%) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken minimum acidity (%) (0.32). Control (T_0) was taken maximum acidity (%) (0.62). The data shown that application of different integrated nutrient management have significant effect on total sugars (%) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum total sugars (%) (10.95). Control (T_0) was taken minimum total sugars (%) (8.37). The data shown that application of different integrated nutrient management have significant effect on reducing sugars (%) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum reducing sugars (%) (6.08). Control (T_0) was taken minimum reducing sugars (%) (4.82). The data shown that application of different integrated nutrient management have significant effect on non-reducing sugars (%) as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotoabacter) was taken maximum non-reducing sugars (%) (4.87). Control (T_0) was taken minimum non-reducing sugars (%) (3.55). The data shown that application of

different integrated nutrient management have significant effect on sugar-acid ratio as compare to control (T_0). Treatment T_9 (75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotobacter) was taken maximum sugar-acid ratio (35.51). Control (T_0) was taken minimum sugar-acid ratio (19.05). Intake of potassium influenced fruit quality and in combination with Azotobacter and PSB amplified better results. Organic manure such as neem cake and

vermicompost also contributed to fruit quality attributes. Similar findings were reported by Kundu *et al.* (2007) [15], Kumar *et al.* (2009) [14], Maity *et al.* (2006) [16], Athani *et al.* (2007) [2, 3, 4], Naik and HariBabu (2007) [17], Katiyar *et al.* (2008) [12], Bashir *et al.* (2009), Deyet *et al.* (2005), Ram *et al.* (2007) [21], Ram and Pathak (2007) [19], Shukla *et al.* (2009) [24], Dutta *et al.* (2010) [9], Dwivedi *et al.* (2010) [10], Rubee *et al.* (2011) and Sharma *et al.* (2016) [23].

Table 1: Effect of integrated nutrient management on fruit growth and yield of guava (*Psidium guajava* L.) cv. Allahabad safeda

Treatment No.	Days to first flower initiation	Number of flowers per tree	Number of flower cluster's per tree	Percentage of fruit set	Number of fruits per tree	Fruit weight (g)	Polar diameter (cm)	Radial diameter (cm)	Specific gravity (w/v)	Fruit yield (kg/tree)	Fruit yield(t/ha)
T_0	39.62	258.71	178.02	41.19	106.57	80.13	5.46	6.21	0.57	8.54	13.32
T_1	35.70	439.07	314.02	47.61	209.07	109.31	6.03	6.65	0.61	22.86	35.65
T_2	34.31	476.89	328.03	55.74	265.80	126.69	6.76	7.43	0.71	33.69	52.56
T_3	32.92	483.57	341.70	57.91	280.05	132.47	7.05	7.53	0.73	37.10	57.87
T_4	31.72	512.78	357.97	48.92	250.84	114.06	6.11	7.05	0.62	28.61	44.63
T_5	30.34	517.90	364.65	50.48	261.44	120.98	6.34	7.23	0.67	31.63	49.34
T_6	27.26	524.35	411.92	60.98	319.73	159.11	7.51	7.81	0.76	50.87	79.36
T_7	29.44	519.77	384.53	59.28	308.08	149.17	7.43	7.47	0.72	45.96	71.69
T_8	25.73	539.05	431.44	65.85	354.99	172.17	7.65	8.11	0.81	61.13	95.36
T_9	21.60	551.63	470.93	68.29	376.68	185.10	7.77	8.51	0.86	69.72	108.77
C.D.	1.520	5.408	10.126	1.418	5.828	3.227	0.145	0.157	0.012	1.288	2.008
SE(m)	0.508	1.806	3.382	0.474	1.947	1.078	0.048	0.052	0.004	0.430	0.671
SE(d)	0.718	2.554	4.783	0.670	2.753	1.524	0.068	0.074	0.006	0.608	0.949
C.V.	2.849	0.648	1.635	1.474	1.234	1.383	1.230	1.228	0.966	1.909	1.909

Table 2: Effect of integrated nutrient management on and quality of guava (*Psidium guajava* L.) cv. Allahabad safeda

Treatment No.	TSS (Brix ^o)	Ascorbic acid (mg/100 ml of juice)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Sugar-acid ratio
T_0	9.09	158.61	0.62	8.37	4.82	3.55	19.05
T_1	10.65	188.71	0.58	9.06	5.03	4.03	21.67
T_2	11.67	201.30	0.47	9.72	5.37	4.35	27.30
T_3	11.74	206.26	0.45	9.84	5.43	4.41	28.11
T_4	11.28	196.02	0.55	9.27	5.12	4.15	24.92
T_5	11.46	198.03	0.52	9.56	5.25	4.31	25.87
T_6	12.33	214.79	0.38	10.35	5.69	4.66	31.61
T_7	12.06	210.29	0.41	10.07	5.58	4.49	29.16
T_8	12.64	218.61	0.35	10.67	5.88	4.79	33.31
T_9	12.76	221.43	0.32	10.95	6.08	4.87	35.51
C.D.	0.172	1.751	0.029	0.139	0.084	0.084	1.003
SE(m)	0.057	0.585	0.010	0.046	0.028	0.028	0.335
SE(d)	0.081	0.827	0.014	0.066	0.040	0.040	0.474
C.V.	0.858	0.503	3.646	0.821	0.897	1.120	2.099

Conclusion

In the present investigation concluded that among the different treatment combinations the treatment T_9 75% Recommended dose of N P K + 25 kg FYM.+6kg Vermocompost +3kg Neem cake + 250g PSB and Azotobacter) was superior in respect to fruit growth, yield and quality parameters.

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